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ALL-UNION SCIENTIFIC CONFERENCE ON THE
PROBLEMS OF INDUSTRIAL HYGIENE AND THE
BIOLOGICAL ACTION OF ELECTROMAGNETIC WAVES

- USSR -

By
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FOREWORD

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-USSR-

[Following is the translation of an article entitled "Vsesoyuznaya Nauchnaya Konferentsiya po Voprosam Gigiyeny Truda i Biologicheskogo Deystviya Electromagnitnykh voln" (English version above) by S. V. Gordon in Vestnik Akademii Meditsinskikh Nauk SSSR (Journal of Medical Sciences USSR). Vol 15, No 4, Moscow, 1960. Pages 82-86.]

The first scientific conference on questions of dosimetry and the hygienic evaluation of electromagnetic fields in work with generators of high and ultra high frequencies was called together by the Institute of Labor Hygiene and Occupational Afflictions in 1955. At this conference special attention was devoted to critical discussion of results of hygienic evaluation of the intensity of irradiation; results which differed sharply as represented in the reports of the Leningrad and Gor'kiy Institutes of Labor Hygiene and Occupational Diseases. The difference in results was primarily due to the fact that the research was conducted with various measuring devices and by means of varying methods of objective evaluation of tension in electro-magnetic fields of high frequency at places of work.

The main conclusion of the 1955 conference was that it is necessary to achieve uniformity in the measuring devices and in the methods of evaluation of tension in electromagnetic fields of high frequency at places of work. The conference marks the beginning of research into a new occupational and industrial factor of environment.

Since that time more than four years have passed. On 26-28 October 1959 the Institute of Labor Hygiene and Occupational Diseases of the Academy of Medical Sciences USSR called together an All-Union conference devoted to the problems of Labor Hygiene and of the biological effect of the electromagnetic waves of radio frequencies (the spectrum of radio waves ranges from millimeters to thousands of meters).

The years that have passed between the conferences have been utilized for the study of this new, from the hygienic point of view, physical factor. The spectrum of waves which are being studied has expanded, the measuring devices and the methods used in scientific

investigation have been standardized, maximum intensities of irradiation in new wave spectra have appeared, means of safeguarding against them have been recommended, and the character of biological effects of this factor has been studied in experiments with animals.

The range and scope of research in this field has expanded as well, in the Kharkov and Sverdlovsk Institutes of Labor Hygiene and Occupational Diseases, the Department of Obstetrics and Gynecology I MOLMI, (I Moskovskiy ordena Lenina meditsinskiy institut -- First Moscow Order of Lenin Medical Institute), a number of scientific research institutes and agencies in the field of radio electronics and radio technique.

Opening the conference, the Director of the Institute of Labor Hygiene and Occupational Diseases, AMN USSR, Active Member of the AMN USSR Prof A. A. Letavet stressed the special importance which the study of working conditions and of biological effects of the electromagnetic radio waves of various spectra acquire now, in this epoch of radio electronics. Thirty-six reports submitted by the Institutes of Labor Hygiene and Occupational Afflictions of the AMN USSR, the Leningrad, Gor'kiy, Sverdlovsk, and Kharkov Institutes of Labor Protection, All-Union Central Council of Trade Unions, the Chair of Obstetrics and Gynecology of the First Moscow Order of Lenin Medical Institute imeni Sechenov and other scientific research organizations were read at the conference..

Unlike the scientific conference of 1955, this conference heard no doubts voiced on the problem of the juxtaposition of findings and data on the number of spectra of radio frequencies as presented in the reports. This situation could only have been achieved thanks to the cooperation of technical and scientific research institutes which had participated in the creation of individual measuring devices, and in the methods of measuring in the intermediate frequency spectrum; the widest acceptance in the research conducted by institutes has been gained by a device for diapason VCh perfected by the Leningrad Institute of Labor Protection. All of this has made it possible to arrive at the correct evaluation of hygienic labor conditions and to establish correlations between physical parameters and biological reactions of the organism.

The reports presented at the conference touched upon new findings and generalizations in the field of hygienic, clinical and experimental research into the effects of electromagnetic waves of radio frequencies upon the organism of man and animals.

A report which generalized and summarized the results of complex scientific investigations on the electromagnetic waves of radio frequencies was submitted by Z. V. Gordon (the Institute of Labor Hygiene and Occupational Affliction AMN USSR). Hygienic, clinical-physiological, experimental and radio-physical research has made it possible in the first phase to detect the character of biological effects of the SVCh field on the organism, primarily with regard to the diapason of waves was a range of fluctuation of one centimeter, to determine the maximum

permissible intensities of irradiation, to work out the fundamentals of prophylactic and defensive measures, which have already gained wide acceptance and utilization in industry and health protection. The report stressed the main direction of work, the direction connected with research in instances of intensities of radiation which do not call forth the heat effect (quantities encountered under conditions of industry).

Research into the character of the biological effects of the SVCh field of low intensity in "chronic" experiment with animals as well as in clinical-physiological investigations in the work with radiation sources, have made it possible to detect the special sensitivity of the central nervous system and of its vegetative section to this physical factor. However, the cause of biological shifts within the organism lies not in the destructive irreversible processes, but in the finer reversible changes which apparently have a reflectory character more often than not. Complex investigations, as they succeed in accumulating material, confirm the viewpoint of the Institute on the functional accumulation of the biological effect in cases of action by the intermediate frequency field of low intensity.

Particular attention was devoted in the report to the ways of approach with regard to the determining of maximum permissible intensities of irradiation and, finally, to subsequent tasks of research.

Reports by associates of the Institute Ye. A. Lobanova, I. A. Kitsovskaya, M. S. Tolgskaya, M. N. Sadichikova, A. A. Orlova, S. F. Belova, V. V. Sokolov, M. N. Ariyevich, N. A. Chulina, I. A. Gel'fon, K. G. Knorre, B. M. Belifskiy, K. V. Nikonova, P. P. Fukalova, N. N. Parfenov presented the principal findings of research in detail.

The hygienic characteristic of working conditions as concerns the intensity, duration of effect, and the spectrum of radio waves (intermediate frequency field), as reported by Z. V. Gordon and B. M. Belitskiy, served as the basis for analysis of a large amount of material presented by a group of reports devoted to clinical-physiological investigations.

N. M. Sadchikova and A. A. Orlova presented in their reports a general clinical syndrome for cases in which the whole spectrum of radio waves exerts an effect; as well as the degree of manifestation of neurological disorders and functional deviations on the part of the heart and circulatory system, depending on the physical hygienic parameters of the environment. The authors had demonstrated that a systematic effect of low intensities of irradiation calls forth, predominately, the development of a complex of symptoms of an asthenic state; however, in instances of periodic effect of irradiation of more significant intensity (centimeter and millimeter waves) the functional deviations on the part of the heart and the circulatory system, which take place in the vagotonic background, become more pronounced.

A report by S. F. Belova was devoted to the changes in the crystalline lens of the eye, changes of considerable intensity connected with effects of the intermediate frequency field.

Certain biochemical changes in human blood -- disruption of protein exchange and increases in the amount of histamine, noted in the report of I. A. Helfon and M. N. Sadchikova; changes in the functional state of the olfactory sense analyzer in cases of chronic effect by centimeter waves, included in the report by Ye. A. Lobanova and Z. V. Gordon, testify to the presence of functional shifts, which can serve to a certain degree as signs of effects of the intermediate frequency field.

A report by V. V. Sokolov, M. N. Ariyevich and N. A. Chulina offered a preliminary analysis of the condition of peripheral blood in cases of action of radio waves of various frequencies upon the organism.

Several reports from the Institute of Labor Hygiene and Occupation Afflictions of the AMN USSR were devoted to the experimental study of the problem.

Ye. A. Lobanova reported on the changes in the conditioned reflex activity in animals subjected to the effect of centimeter waves of low intensity. At the base of the changes manifested in the lowering of excitation, and in the deepening of inhibitory processes, lie the functionally reversible morphological changes in the interneural connections of the surface of the brain, detected by M. S. Tolgskaya. An analogous effect of this factor was shown in the report by I. A. Kitsovskaya for cases of irradiation of rats, who are particularly sensitive to audio-irritants.

Early reactions of the blood vessel tonus to the effects of the intermediate frequency field of low intensity were discussed in the report by S. F. Belova who had employed the method of elastotonometry.

M. S. Tolgskaya had demonstrated quite convincingly that low intensities of irradiation by centimeter waves produced changes in the preterminal parts of receptors in various receptor zones. This is in agreement with our previous research, which had shown changes in oxidendral and oximatic synapses under the same conditions of effect. The obtained data involved the changes in the receptors of individual receptor fields, which served, in the opinion of V. N. Chernigovskiy, as a source of reflexes with respect to blood circulation and respiration, as well as the changes in the cells of the hypothalamic area, detected by M. S. Dolgskaya, can explain, to a certain degree, the autonomous reactions observable in the clinic and in experiments, in particular the abrupt lowering of the blood pressure level.

A report by K. G. Knorre and B. M. Velitskiy proposes a method of direct determination of the coefficient for absorbed energy in the object being tested at any degree of its heterogeneity. Biophysical research of this nature is extremely valuable for the clarification of the action mechanism of the factor under investigation. The same authors reported on the basic means of defense in cases of work with intermediate frequency generators.

K. V. Nikonova, B. P. Fukalova and N. N. Parfenov shared their experience in working with the lowering of intensity of high frequency electromagnetic fields in places of work.

A report by K. G. Knorre deserves attention in connection with the expansion of the ~~spectra~~ of radio frequencies, in which hygienic research is conducted, as well as in connection with the difference in the character of the electromagnetic fields of radio frequencies. The author proposed the adaptation of a single rational system of measurement of the intensity of irradiation for the whole spectrum of radio frequencies.

The Leningrad Institute of Labor Hygiene and Occupational Diseases submitted the next grouping of reports.

A report by Yu. A. Osipov was devoted to the tasks and prospects of the further hygienic study of industrial electromagnetic fields of radio frequencies. A report by T. V. Kalyadya, E. L. Kulikovskaya and Y. A. Osipov offered a detailed hygienic characterization of conditions of the intermediate frequency irradiation in skin tests (shvartovyye ispytaniya).

N. V. Uspenskaya reported on the results of observations of people actually working under the effects of centimeter waves, which show that the longer the period of such work the greater the number of persons having a pronounced characteristic syndrome related to the specific factor.

A report by T. S. Asanova, R. N. Vol'fovskaya, T. V. Kalya, Ye. L. Kulikovskaya, Yu. A. Osipov, and A. V. Shcheglovaya concerned the clinical hygienic characteristics of working conditions in a high frequency and x-radiation field.

The authors detected a combination of two physical factors -- electromagnetic fields of high frequency and high and low tension on one hand and of small X-ray dosages -- in sectors testing vacuum tubes in the vacuum [-tube?] industry. Dynamic observations of the health of persons working in those sectors have shown cumulative growths of clinical symptoms as the duration of work lengthened, which indicates the chronic effect of the mentioned factors.

T. V. Kalyada, Ye. L. Kulikovskaya and Yu. A. Osipov, in their report on the physiological shifts in the thermo-regulatory apparatus and in the central nervous system in cases of work with the HF and UHF fields, have shown that the functional shifts in the course of the workday are more pronounced in persons working in the latter field, although the intensity of irradiation is lower in this case than in the HF field.

The Gor'ky Institute of Labor Hygiene and Occupational Diseases submitted a report by Ye. I. Smurova on problems of labor hygiene in areas where high frequency currents are employed. The same Institute submitted a report by a clinical group G. Z. Rogova, S. A. Troitskiy, N. A. Lashchenko and N. D. Mel'nikov devoted to the health status of workers who are in extended contact with high-frequency currents. These reports were of special interest because the researchers had conducted observations on a certain group of persons and their working conditions over a span of 8-10 years. Their conclusions, which in the main coincide with the findings of other researchers, are of considerable value.

The Sverdlov Institute of Labor Hygiene and Occupational Diseases (T. K. Butkin, A. S. Vorontsova, Ye. Ya. Girskaia, L. R. Dubrovskaya, K. W. Klyachina, I. Ye. Okonishnikova, B. M. Stolbun, L. V. Trofiunova, Z. M. Sharonova) submitted a report on the sanitary and hygienic working conditions and on the health of persons subjected to a simultaneous effect of mild X-ray radiation (the daily and weekly dosage being below the permissible maximum and of centimeter waves. Along with the clinical picture, characterizing the effect of the medium high frequency field, the authors noted significant changes in the white blood corpuscles (leucopenium, trombopenium).

Great interest was generated by a report of A. M. Paladin, I. M. Spasskaya and R. S. Yakubovich (I MOLMI chair of Obstetrics and Gynecology), "On the Health of Women Working Around Intermediate Frequency Generators." It may well be that thus we have started for the first time to conduct research which is urgently necessary. Preliminary data had enabled the investigators to make an assumption on the effect of the intermediate-frequency field upon the hypolactosis, which is, possibly, connected with the observed hypothyreny.

A report by L. A. Dolina (State Scientific Research Institute of Kurctology and Physiotherapy, Moscow) offered a large and interesting body of experimental morphological material on the effect of centimeter waves of very high intensity on the animal organism. The dyscirculatory and dystrophic changes detected in the central autonomous nervous system and in the internal organs, the author regards as a result of anoxemic phenomena in the central nervous system as a result of the reflex disruption of the central regulation of blood circulation.

The biophysics report by Engineer V. A. Franke Leningrad Institute of Labor Protection, All-Union Central Council of Trade Unions on the dependence of energy absorption by the human body in an electromagnetic field on frequency (computational data) called forth great interest among the participants of the conference. V. A. Franke demonstrated that the quantity of absorbed energy depends on the frequency spectrum and that in the spectrum of metric waves maxima of resonance are possible.

The general approval of the conference was urged by the report of Engineer I. D. Bolshukhin (Leningrad), who reported on the results of his work on screening of certain types of the HF generators.

The above mentioned reports led to lively discussion in which thirty-eight persons participated (Ye. Ts. Andreyeva-Galanina, V. A. Litkius, A. A. Letavet, N. F. Galanin, O. F. Ushinskaya, Yu. A. Osipov, Z. V. Gordon, V. A. Franke, M. A. Kovnatskiy, A. L. Morozov, E. A. Drogichina, A. V. Triunifov, I. G. Fridlyarid, E. B. Kurlyandskaya and others.

Statements by Ye. Ts. Andreyeva-Galanina were quite interesting. Pointing out the special complexity of research into this factor of the external environment, she emphasized the necessity of studying the deep processes which take place in the cellular substance in instances of action upon them by electromagnetic waves of radio frequencies, for which experimental studies on animals are naturally necessary.

Prof V. A. Litkins noted the valuable experience gained in the work of the Institute of Labor Hygiene and Occupational Diseases, AMN USSR -- experience which has been reflected in the intrainstitutional complex of research (hygienic, clinical, and experimental), as well as in the diversification of research in cooperation with interested industrial organizations and with technical and scientific research institutes. He also gave a positive evaluation of the work reported by the Sverdlovsk Institute of Labor Hygiene and Occupational Afflictions, and stressed the necessity of equipping the institutes and the practical workers with special measuring apparatus needed for determining the intensity of irradiation by radio waves.

Zhigulin (The Institute of Radiotechniques AN USSR, Moscow) emphasized the point that the drawing of physicists and chemists into research work would aid in a more rapid clarification of the initial mechanism of the effect of electromagnetic waves of radio frequencies. He also voiced an opinion on the purposefulness of studying the resonance absorption of the energy of radio waves by organic substances, including albumen.

V. M. Petiforov (Moscow) criticized certain postulates contained in the report by E. Ya. Girskaia and coauthors. "On the Sanitary-Hygienic Working Conditions and on the State of Health of Persons Subjected to a Simultaneous Action of X-ray Radiation and of Centimeter Waves" (Sverdlovsk), postulates connected with the dosimetrics of the salt X-ray radiation. The absence of dosimeters for the mild X-ray radiation and the employment of dosimeters which were not intended for this spectrum of X-ray radiation, does not allow an evaluation of obtained measurement results from the viewpoint of maximum permissible dosages.

Engineer S. G. Molochnikov (Sverdlovsk) noted the unsatisfactory situation with regard to the clarification of the problem of combined action of the intermediate frequency field on one hand and of the soft X-ray radiation on the other. He also mentioned the necessity of determining a harmless lower limit of the intensity of irradiation.

O. F. Ushinskaya (Leningrad Institute of Labor Protection) devoted her speech to the problem of the screening of the HF range, principally of its magnetic component.

V. A. Franke (Leningrad Institute of Labor Protection) gave a positive appraisal of the rational system of measuring of irradiation intensity which had been proposed by K. G. Knorre. He evaluated that system as fully valid in terms of physics. However, in his opinion the adaptation of this system to practice required a certain preparation of hygienists for it.

Y. A. Osipov (Leningrad) noted the considerable effectiveness of screening by blocks (poblochnoye ekranirovaniye), which was presented in the report submitted by Engineer I. D. Bol'shukhin (Leningrad).

Yu. A. Osipov, while expressing his disagreement concerning the predominant action of the magnetic component of the VCh field, does, however, think that it is possible to support the Leningrad Institute

of Labor Protection, which will work out corresponding methods of screening in 1960.

Prof N. F. Galanin emphasized as a positive phenomenon the complexity of research in progress into the effects upon the organism of the electromagnetic waves of radio frequencies.

A grouping of clinical reports was subjected to special discussion.

Prof A. V. Triumphov (Leningrad) made a note of the quite interesting findings offered by A. A. Orlova pertaining to the pronounced deviations in the cardiovascular system in persons who were subjected to the action of millimetric waves, which apparently serves as proof of the reflex factor in the mechanism of action of the phenomenon under investigation.

Prof I. G. Fridlyand (Leningrad) made a number of essential remarks on the clinical use of the statistic method of processing material and stressed the necessity of a more complex examination of the clinical syndrome.

S. M. Knevskeya (Gor'kiy), M. A. Kovnatskiy and a number of other speakers stressed the special interest generated by the report of Prof A. M. Palladin and coauthors in connection with the absolute lack of studies on the question of the work of female labor under conditions of the action of the intermediate frequency field.

Prof A. L. Morozov and M. A. Kovnatskiy noted with satisfaction that the findings of clinical research submitted in the reports of the Institute of Labor Hygiene and Occupational Diseases, AMN USSR, and the Leningrad Institute coincide, which testifies to the correctness of the direction followed in the work and that it is necessary at the present time to press research in depth.

E. A. Drogichina stressed the point that the peculiarity of the clinical syndrome lies in the selective action and in the pronounced degree of parasympathetic reactions in instances of intensive action by the intermediate frequency field. When the intensity of irradiation is decreased, even a systematic action upon the organism does not call forth a selective reaction, but leads to the exhaustion of the nervous system; an exhaustion which accumulates. In both the first and the second cases, the phenomena of cumulation of biological effect are obvious.

The conference terminated its work with a discussion of a number of reports devoted to the clarification of the pathogenesis of the action of the intermediate frequency field in experiments with animals, and to the biophysical orientation of research.

A. S. Presman (State Scientific Research Institute of Kurology and Physiotherapy) considers that there is no necessity to investigate the integral absorption of energy in the bio-object, and that there is no need to complicate energy measurements in space by a subsequent orientation toward one single system of units.

A. G. Subbota (Leningrad) noted that the submitted materials are in agreement with findings obtained by him. He discussed in detail the interrelationship of the phenomena of adaptation and cumulation.

The conference adopted a broad resolution on the further expansion of research throughout the whole spectrum of radio frequencies employed in industry, science, and technology, in which research special attention should be devoted to the study of the mechanism of the biological action and to the introduction of the results obtained through research into the practical actuality of health protection. The resolution also noted the necessity of intensifying the complex of work in cooperation with radio-physicists and radio engineers. In order to elevate the level of knowledge on the part of medical workers in the field of the effects of electromagnetic waves of radio frequencies, the conference asked the Ministry of Public Health USSR, to introduce a special study section into the course of labor hygiene taught in medical institutes and in the institutes devoted to the furthering of the professional qualifications of doctors.

Candidate of Medical Sciences Z. V. Gordon